DEVELOPMENT AND PERFORMANCE OF LILLE'S FOURIER TRANSFORM MILLIMETER-WAVE SPECTROMETER

LUYAO ZOU, R. A. MOTIYENKO, L. MARGULÈS, *UMR 8523 CNRS - Université de Lille, Laboratoire PhLAM, Villeneuve d'Ascq, France*; E. A. ALEKSEEV, *Radiospectrometry Department, Institute of Radio Astronomy of NASU, Kharkov, Ukraine*.

Fast spectral acquisition is an essential component in obtaining broadband molecular spectra with high signal to noise ratio, and in studying meta-stable molecular species. With the recent developments on commercially available arbitrary waveform generators (AWG), direct digital synthesizers (DDS), and room-temperature Schottky diodes, it is feasible now to perform fast spectroscopy scans using the heterodyne detection of the free induction decay of molecules in the millimeter wave bands, as demonstrated by a few pioneer spectrometer designs.[a] At Lille, we have developed and demonstrated the Fourier transform millimeter-wave (FTmmW) spectrometer system based on DDS.[b] This spectrometer has a simplified design which does not require external reference clocks or local oscillators, yet it achieves decent frequency resolution and high phase stability. Since then, several upgrades, including new frequency sweep scheme and filter applications, have been made to improve the spectral purity and scan bandwidth of this FTmmW system. The results of the detailed performance test of bandwidth, sensitivity and data acquisition rate on the upgraded system will be presented. The advantages and limitations of the spectrometer for conducting fast millimeter spectroscopy on atmospheric radicals will be discussed.

The authors thank the Région Hauts-de-France, and the Ministère de l'Enseignement Supérieur et de la Recherche (CPER Climibio), the French ANR Labex CaPPA through the PIA (contract ANR-11-LABX-0005-01), and the European Fund for Regional Economic Development for their financial support.

[a] E. Gerecht, K. O. Douglass and D. F. Plusquellic, 2011, *Opt. Expr.*, **19**, 8973; I. A. Finneran, D. B. Holland, P. B. Carrol *et al.*, 2013, *Rev. Sci. Instrum.*, **84**, 083104.

[b] R. A. Motiyenko and L. Margulès, ISMS 73rd symposium (2018), WI07.